

REMARKS

Claims 1-4, 6-8, and 10-11 are now pending in this application. Claims 1, 4, and 6 are independent. Claims 10-11 have been added; claim 1 has been amended; and claims 5 and 9 have been canceled by this Amendment.

Anticipation Rejection Over Dittman et al. (US 5,763,854)

Withdrawal of the rejection of claims 1, 4, 5, and 9 under 35 U.S.C. §102(b) as being anticipated by Dittman et al. is requested. Claims 5 and 9 have been canceled, thus rendering their rejection moot.

Applicant notes that anticipation requires the disclosure, in a prior art reference, of each and every limitation as set forth in the claims.¹ There must be no difference between the claimed invention and reference disclosure for an anticipation rejection under 35 U.S.C. §102.² To properly anticipate a claim, the reference must teach every element of the claim.³ “A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference”.⁴ “The identical invention must be shown in as complete detail as is contained in the ...claim.”⁵ In determining anticipation, no claim limitation may be ignored.⁶

Discussion of Applicants’ Disclosure

By way of background, the present application, in various embodiments, is directed to a method of making and a semiconductor having a metal terminal formed on not only on its back surface, but also on a side surface used as a target of solder jointing. Further, in the method, a laser beam is irradiated on the side surface of the metal terminal so that indirect heating is used.

That is, the component body is heated by irradiating laser beam on the side surface of the metal terminal, which is different from the back surface where the solder cream is present. By irradiating the side surface, the component body is heated, and this heat conduction enables the

¹ *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir. 1985).

² *Scripps Clinic and Research Foundation v. Genentech, Inc.*, 18 USPQ2d 1001 (Fed. Cir. 1991).

³ See MPEP § 2131.

⁴ *Verdegaal Bros. v. Union Oil Co. of Calif.*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

⁵ *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

solder located on the back surface of the component to melt and solder this surface. In addition, by irradiating the side surface of the metal terminal, the temperature of the side surface is raised sufficiently to cause a suction effect inducing the solder on the back surface to the side surface, and enables soldering the side surface simultaneously.

Further, the disclosed and claimed invention is directed to a process of solder joining a component that has no lead sticking out from the semiconductor part. Instead, the electrode is layered on both the back surface and the side surface of the component body.

The electrode of the targeted component is present on both the back surface and the side surface, and to make an effective solder joint, it is necessary to solder (*i.e.*, “wet the solder”) on both the back surface and the side surface.

The laser beam irradiated on the side surface heats the component body and melts the solder on the back surface through thermal conduction, which makes it possible to solder the electrode on the back surface.

The side is solder jointed by inducing (“sucking up”) the melted solder on the back surface. In order to do this, it is necessary to bring the temperature of the side surface above the melting point of the solder. By irradiating the side surface, the electrode on the side surface is heated to high temperature, which makes it less difficult to draw up the solder to joint the side surface. Thus, irradiating laser beam on the side surface enables soldering both the back surface and the side surface simultaneously and with ease. This is a significant factor involved with irradiating the side surface.

Distinctions over the Applied Art

In general, none of the applied art discloses the laser beam irradiating on the side surface of a metal terminal, which is a different position from the back surface where the solder is located. Further, the solder is liquefied (melted) by heat conduction not only involving the conduction on the metal terminal, but also utilizing the heat conducted through the component body. Finally, the liquefied solder on the back surface is induced on the side surface to simultaneously solder this surface.

⁶ *Pac-Tex, Inc. v. Amerace Corp.*, 14 USPQ2d 187 (Fed. Cir. 1990).

Dittman et al. generally disclose soldering by heat conduction. However, in Dittman et al., the position of lead 208 provided from flex cable 210 is where the laser beam is irradiated, and the position of pad 212, where it is soldered, are in correspondence and direct registration with each other, i.e., they are located in the same location. Thus, the heat is conducted directly from lead 208 onto pad 212. This contention is made even more clear by the exposition of Dittman's FIG. 7.

In particular, the applied art does not disclose a method of soldering a semiconductor part, which includes, among other features, "...mounting a semiconductor part in which a metal terminal is formed on a back surface and a side surface on said cream solder so that only a back surface portion of said metal terminal is in contact with said cream solder; and performing solder joining of said land and said semiconductor part by irradiating only a side surface portion of said metal terminal with laser beams", as recited in independent claim 1, as amended.

Further, the applied art does not disclose a mounted structure of a semiconductor part, wherein, among other features, "...on a land of a circuit substrate, a semiconductor part having a metal terminal on a back surface and a side surface is mounted, via a cream solder printed on said land, so that almost all area of said land is opposed to a mounting surface of said semiconductor part and said land and said semiconductor part are solder jointed...", as recited in independent claim 4.

Accordingly, since the applied art does not disclose all the claimed features of independent claims 1 and 4, reconsideration and allowance of claims 1-4 are respectfully requested.

Anticipation Rejection Over Matsushita

Withdrawal of the rejection of claims 1, 4, 5, and 9 under 35 U.S.C. 102(b) as being anticipated by Matsushita (JP 05-069182 A) is requested. Claims 5 and 9 have been canceled, thus rendering their rejection moot. The legal requirements for anticipation have been set forth above.

The Examiner asserts that Matsushita discloses a method of soldering an electronic device comprising the steps of printing a cream solder on a contact on a circuit substrate having a

metal terminal (2) on the back surface and performing solder joining via a laser beam as in FIG. 3 and the Abstract.

Applicants submit that Matsushita is identical to what is mentioned as conventional or background art in the present specification, and that Matsushita does not represent Applicants' disclosed or claimed invention, particularly with respect to the method.

Applicants' disclosed and claimed invention involves a semiconductor part with a metal terminal formed on not only on the back surface, but also on the side surface of the semiconductor part, and also that the side surface is used as a target of solder joining by irradiating the side portion of the metal terminal with a laser beam on.

In contrast, Matsushita discloses a process of solder jointing by irradiating laser beam on the surface 7 of electrode 6, and also discloses black coating 4 (flux which is mixed with a black substance, e.g., graphite) that is chosen to be black for heat absorption reasons. Even if electrode (lead) 6 is equivalent to the metal terminal as claimed, it only comprises laser beam irradiation on a metal terminal, and does not comprise laser beam irradiation on the *side* surface of the metal terminal as is claimed in independent claim 1. The applied art discloses the process of solder jointing a lead that is sticking out from the semiconductor part.

Distinctions over the Applied Art

Specifically, the applied art does not disclose a method of soldering a semiconductor part, which includes, among other features, "...mounting a semiconductor part in which a metal terminal is formed on a back surface and a side surface on said cream solder so that only a back surface portion of said metal terminal is in contact with said cream solder; and performing solder joining of said land and said semiconductor part by irradiating a side surface portion of said metal terminal with laser beams", as recited in independent claim 1.

In addition, the applied art does not disclose a mounted structure of a semiconductor part, wherein, among other features, "...on a land of a circuit substrate, a semiconductor part having a metal terminal on a back surface and a side surface is mounted, via a cream solder printed on said land, so that almost all area of said land is opposed to a mounting surface of said

semiconductor part and said land and said semiconductor part are solder jointed..., as recited in independent claim 4.

Accordingly, since the applied art does not disclose all the claimed features of independent claims 1 and 4, reconsideration and allowance of claims 1-4 are respectfully requested.

Anticipation Rejection Over Takanashi et al.

Withdrawal of the rejection of claims 1, 4, 5, 6, and 9 under 35 U.S.C. 102(b) as being anticipated by Takanashi et al. (US 5842627) is requested. Claims 5 and 9 have been canceled, thus rendering their rejection moot. The legal requirements for anticipation have been set forth above.

The Examiner asserts that Takanashi et al. teaches a method of soldering an electronic device comprising the steps of printing a cream solder on a contact on a circuit substrate having a metal terminal (52) on the back surface, performing solder joining via laser and supplying cold air to the surface such that the surface reaches a prescribed temperature.

Applicants submit that Takanashi et al. is identical to what is mentioned as conventional or background art in the present specification, and that Takanashi et al. does not represent Applicants' disclosed or claimed invention, as discussed above.

Arguably, Takanashi et al. mention supplying cold air, but the applied art only discloses that it forces cooling the melted solder below its melting temperature.

In contrast, the disclosed and claimed invention is further distinguished over Takanashi et al. by the fact that cooling air is supplied to the surface of the semiconductor part without a metal terminal formed thereon, *i.e.*, a different surface from the location of soldering. Further, temperature conditions are set so that a difference between a temperature near the metal terminal which is irradiated with the laser beam and a temperature near the surface which is supplied with cold air is maintained within a prescribed temperature range.

Distinctions over the Applied Art

Specifically, the applied art does not disclose a method of soldering a semiconductor part, which includes, among other features, "...mounting a semiconductor part in which a metal terminal is formed on a back surface and a side surface on said cream solder so that only a back surface portion of said metal terminal is in contact with said cream solder; and performing solder joining of said land and said semiconductor part by irradiating only a side surface portion of said metal terminal with laser beams", as recited in independent claim 1.

In addition, the applied art does not disclose a mounted structure of a semiconductor part, wherein, among other features, "...on a land of a circuit substrate, a semiconductor part having a metal terminal on a back surface and a side surface is mounted, via a cream solder printed on said land, so that almost all area of said land is opposed to a mounting surface of said semiconductor part and said land and said semiconductor part are solder jointed...", as recited in independent claim 4.

Further, the applied art does not disclose a method of soldering a heat sensitive semiconductor part incapable of being passed through a reflow furnace to a circuit substrate, wherein the method includes "...providing a heat sensitive semiconductor part incapable of being passed through a reflow furnace, wherein the semiconductor part has a metal terminal formed on both a back surface portion and a side surface portion of the semiconductor part; mounting the back surface portion of the metal terminal on said cream solder so that only the back surface portion of said metal terminal is in contact with said cream solder; irradiating *only* the side surface portion of the metal terminal with a laser beam...", as recited in independent claim 6.

The dependent claims further distinguish over the applied art. For example, the applied art does not disclose the method of claim 2 which further includes, "...in said step of performing solder joining, cold air is supplied to a surface of said semiconductor part on which said metal terminal is not formed", as recited.

Accordingly, since the applied art does not disclose all the claimed features of independent claims 1 and 4, reconsideration and allowance of claims 1-4 are respectfully requested.

Unpatentability Rejection over Takanashi et al.

Withdrawal of the rejection of claims 2, 3, 7, and 8 under 35 U.S.C. §103(a) as being unpatentable over Takanashi et al. (US 5,842,627) is requested.

At the outset, Applicant notes that, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference must teach or suggest all the claim limitations.⁷ Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure.⁸

The Examiner contends that "an identical structure can be formed by other methods including but not limited to oven and vapor phase reflow of preformed solder balls." However, Applicants point out that claims 2, 3, 7, and 8 are method claims, and whether or not identical structures exist or not, the present method is submitted as being novel and non-obvious.

The Examiner contends that it would have been obvious to a person of ordinary skill in the art to employ, in the teachings of Takanashi, at least one cooling pipe that directs cooling air to areas away from solder to control cooling of the assembly and prevent warping of the substrate.

Whether or not the Examiner's assertion is true, a proposition with which Applicants specifically disagree, Takanashi does not teach or suggest all the limitations discussed above with respect to the anticipation rejection of either independent claim 1 or 6 from which claims 2-3 and 7-8 variously and ultimately depend.

Accordingly, withdrawal of the rejection and allowance of claims 2-3 and 7-8 are respectfully requested.

⁷ See MPEP §2143.

⁸ *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) and *See* MPEP §2143.

New Claims

New method claims 10-11 have been drafted to avoid the applied art and to further define the claimed invention. No new matter is involved with any new claim. Consideration and allowance of new claims 10-11 are respectfully requested.

Conclusion

In view of the above amendment and remarks, applicant believes that each of pending claims 1-4, 6-8, and 10-11 of this application are in immediate condition for allowance. An early indication of the same would be appreciated.

In the event the Examiner believes that an interview would be helpful in resolving any outstanding issues in this case, the undersigned attorney is available at the telephone number indicated below.

Applicant believes no fee is due with this response. However, if a fee is due, please charge CBLH Deposit Account No. 22-0185, under Order No. 22040-00034-US1 from which the undersigned is authorized to draw.

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Respectfully submitted,

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